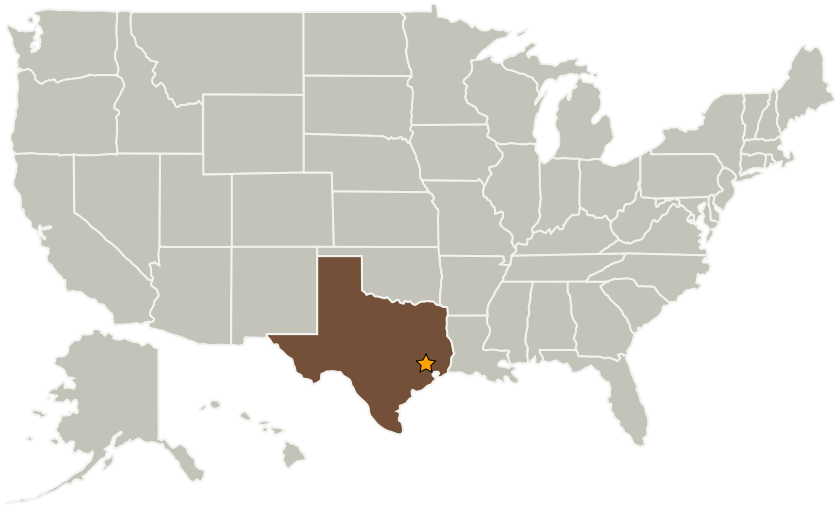
Model-Based Torque Control of Piezoelectric Ultrasonic Motors, Phase I

Completed Technology Project (2004 - 2005)

Project Introduction

Piezoelectric ultrasonic motors (PUMs) are ideal actuators for a variety of spaced-based robotics applications. These motors replace conventional drive systems consisting of motor, gear train, and brake with a rugged and reliable actuator containing one moving part. It is not currently feasible to fully exploit the capabilities of PUMs due to the lack of model-based torque control systems. This research will eliminate the barrier to PUM adoption and lead to model-based torque control algorithms and driver hardware. The key result of the Phase I STTR will be demonstration of the feasibility of model-based torque control of PUMs using a passive inertial load. This result will provide assurance that the overall project result, development of model-based torque control hardware and software, is both feasible and attainable. This result will be achieved via the development of a mathematical model relating motor input parameters and speed to output torque and experimental validation of the model. This Phase I STTR will also produce a design for an enhanced laboratory apparatus incorporating an active load, thus permitting detailed modeling of the space-based robot actuation environment.

Primary U.S. Work Locations and Key Partners



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Tietronix Software, Inc.	Supporting Organization	Industry Small Disadvantaged Business (SDB)	Houston, Texas

Primary U.S. Work Locations
Texas

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.1 Integrated Systems and Ancillary Technologies